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DRAFT ENVIRONMENTAL ASSESSMENT

Seven-Up Pete Joint Venture
McDonald Gold Exploration Project
Exploration License No. 00497

1997 Hydrologic Field Investigations

Prepared by:

The Montana Department of Environmental Quality

and

The Montana Department of Natural Resources & Conservation

Pursuant to:
The Montana Environmental Policy Act

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DEPARTMENT OF ENVIRONMENTAL QUALITY
PERMITTING AND COMPLIANCE DIVISION

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May 9, 1997

Dear Reader:

Enclosed for your review is a Draft Environmental Assessment (EA) prepared jointly by the Department of Environmental Quality and the Department of Natural Resources and Conservation. The EA evaluates a proposal by Seven-Up Pete Joint Venture to conduct hydrological tests at the proposed McDonald Gold Project site east of Lincoln, Montana.

Public comment on this EA will be received by the Department until 5:00 p.m. June 6, 1997. Public hearings will be held to gather oral comments on the proposal in Lincoln, Montana from 7 to 10 pm on May 20, 1997 at the Lincoln High School, Hwy 200 & 8th Avenue, and in Missoula, Montana from 7 to 10 pm on May 21, 1997 at the Missoula College of Technology (Vo Tech), 909 South Avenue West, Health and Business Building, Room HB01.

Comments should address the adequacy of the EA in assessing issues, new information not considered that may influence the analysis, and clarification. Comments should be specific. The Departments will use these comments, the EA, and the application to make a final decision on the proposal.

Written comments should be directed to:

Scott D. Spano
Montana Department of Environmental Quality
Permitting & Compliance Division
PO Box 200901
Helena, MT 59620-0901

Thank you for your time and consideration. Please call me at (406) 444-4955 (office) or (406) 431-1975 (cell phone) if you have any questions or desire to record verbal comments.

Sincerely,

Scott D. Spano, Supervisor
Hard Rock & Placer Exploration Section
Permitting & Compliance Division

Enclosure

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CHAPTER I

INTRODUCTION

A. Proposed Action

The Seven-Up Pete Joint Venture (SPJV) proposes to conduct extended water well pumping tests at the proposed McDonald Gold Project site to provide hydrologic and hydrochemical information for the Venture's mine proposal near Lincoln, Montana. The proposal calls for conducting long-term water well tests scheduled to begin in the Summer of 1997. The tests are designed to simulate dewatering, as would occur during the proposed mine project, and to provide very detailed data over an extended period of time on test wells completed in both major bedrock units (Tuff and TVS-upper). Six existing wells located in the vicinity of the proposed mine pit would be pumped and the water discharged into two infiltration trenches in the Blackfoot alluvial aquifer and one infiltration trench in the Landers Fork alluvial aquifer. Pumping is scheduled to begin in June 1997 and continue through December as weather and other site conditions permit.

The 1997 tests would provide data to allow the current estimates of the required pumping rates for the cut-off wells, and the required number and design of cut-off wells, to be further refined. This, in turn, would allow the overall estimate of the pumped water chemistry and chemical load discharged from the cut-off wells to be refined. It would also allow for testing whether the dewatering can be further optimally managed during mining to reduce overall operational changes to the alluvial aquifers in both valleys.

In addition, alternative infiltration locations would be analyzed that may help reduce effects from the project. These locations will be designed to promote oxidation, settling and filtration to examine the viability of pre-treatment of discharge waters during the actual operation of the proposed mine project.

B. Purpose and Need for Action

The test has the following objectives:

- to further improve confidence in the prediction of hydrologic conditions which would occur over the 16 year mine life

- to provide more detailed, site-specific information on which to base the engineering design of the water management system

- to provide additional data on chemical reactions which would occur as the water is pumped from the dewatering wells and discharged to the alluvial groundwater system

- to optimize discharge locations so that effects to the hydrologic systems in both valleys can be minimized

- to provide information which would allow the agencies to determine how the proposed mine project should be monitored

C. Project Location and Background

The project is located at the confluence of the Blackfoot River and the Landers Fork in Lewis and Clark County, approximately 8 miles east of Lincoln, Montana. Facilities associated with the proposed pump test are located in T14N, R8W, sections 1 and 12, and in T14W, R7W, sections 5, 6, and 7.

Hydrologic testing began in 1995 with extended pumping of dewatering wells in the Tuff unit and discharge of water into infiltration trenches in the Landers Fork and Blackfoot alluvial aquifers. In 1996 hydrologic investigations continued with testing of dewatering wells in the TVS unit to the north of the proposed pit. The discharge water was routed into an infiltration trench in the Landers Fork alluvial aquifer. For both the 1995 and 1996 testing programs, the DEQ designated groundwater mixing zones at each infiltration trench. Groundwater monitoring results show that the contaminants in the discharge water did not migrate outside the designated mixing zones. In fact, metals dissolved in the discharge water did not increase in concentration very far from the infiltration trenches.

D. Land Status

All facilities proposed for the pump test are located on private or state owned land. No federally owned lands are involved.

E. Public Involvement

A four week comment period is planned upon release of this draft EA. In addition, public hearings are planned for Lincoln and Missoula to gather public comments about the proposal.

F. Summary of Prior Legal Action

SPJV's well tests in 1995 and 1996 were the subject of litigation in Montana district court brought by three environmental groups. This litigation has now been concluded at the district court level with the court's final Judgment dated March 31, 1997. Plaintiffs have until May 5, 1997 to appeal this decision to the Montana Supreme Court.

The outcome of each of the principal issues is discussed in the next two paragraphs. The plaintiffs agreed to dismissal of their allegations that DEQ had failed to comply with the Montana Water Quality Act in authorizing the well tests and mixing zones. The court agreed with DEQ that well tests and mixing zones can be authorized under the Metal Mine Reclamation Act. All parties stipulated to dismissal of the plaintiffs' claim that DEQ should have prepared a new or supplemental environmental review document under the Montana Environmental Policy Act upon reauthorizing the 1995 well tests and designating mixing zones. The court agreed with DEQ that the plaintiffs had no valid claim under the Montana Administrative Procedure Act and found that DEQ did not act arbitrarily, capriciously, or unlawfully in authorizing the 1995 well tests.

Finally, the court agreed with the plaintiffs that Article II, Section 3 of the Montana Constitution does provide an inalienable, fundamental right to a "clean and healthful environment" but ultimately ruled in DEQ's favor on the constitutional issue because no environmental harm was shown. The plaintiffs had argued that §75-5-317(2)(j), MCA, of the Montana Water Quality Act violated this right to a "clean and healthful environment" because it created an exemption from "nondegradation review" under §75-5-303, MCA, for a category of actions, i.e. water well tests, which allowed such tests to go forward without regard to the actual effect of such tests on receiving waters. The court noted, however, that discharges from such tests were still required to meet water quality standards and were not permitted to cause pollution. The court found that there was no evidence of any violation of water

quality standards as a result of these tests. The court ruled that, as applied to the actual facts presented thus far, it could not find §75-5-317(2)(j), MCA, to be unconstitutional and granted summary judgment for DEQ on that issue.

G. Agency Responsibilities

The DEQ and DNRC have participated in a joint review of this proposal. The following is a description of agency responsibilities.

1. Department of Environmental Quality (DEQ)

The DEQ must decide whether to approve SPJV's application as proposed, approve with modifications, or deny the permit, as required by the Montana Metal Mine Reclamation Act (MMRA) Title 82, Chapter 4, Part 3, MCA.

The DEQ administers the MMRA which applies to state, federal, and private lands. The purpose of the act is to provide that the usefulness, productivity, and scenic values of all lands and surface waters involved in mining and exploration receive the greatest reasonable degree of protection and reclamation to beneficial use. The act and its rules (ARM 17.24.101 et seq.) set forth the steps to be taken in the issuance of an exploration license for and the reclamation of the applicant's proposed exploration project.

The DEQ is responsible for administration of the Montana Water Quality Act (Title 75, Chapter 5, MCA), providing for the classification of surface waters, establishing surface water quality standards, and administering permit programs to control the discharge of pollutants into state waters.

DEQ's rules (ARM 17.4.601 et seq.) implementing the Montana Environmental Policy Act (MEPA) (Title 75, Chapter 1, MCA) also require preparation of an environmental analysis. The Department has determined that an Environmental Assessment (EA) is appropriate for this project. This EA has several purposes:

a. It serves to ensure that the agencies use the natural and social sciences in environmental planning and decision-making;

b. It assists in the evaluation of reasonable alternatives and the

development of conditions, stipulations or modifications to be made as part of a proposed action;

c. It determines the need to prepare an EIS through an initial evaluation and determination of the significance of impacts associated with a proposed action;

d. It ensures the fullest appropriate opportunity for public review and comment on proposed actions, including alternatives and planned mitigation, where the residual impacts do not warrant an EIS; and

e. It examines and documents the effects of a proposed action on the quality of the human environment, and provides the basis for public review and comment.

Section 82-4-332(1) provides that the Department shall issue an exploration licence to an applicant who pays the application fee, agrees to reclaim disturbed areas, and is not in default of any other reclamation obligation under the MMRA. A person may not be issued an exploration licence if that person has forfeited a reclamation bond, failed to post a reclamation bond, or failed to pay a penalty for which the department has obtained a judgement (82-4-331(3), MCA). SPJV has not forfeited any bonds under the MMRA and has not failed in its reclamation obligations.

2. Department of Natural Resources and Conservation (DNRC)

The DNRC must decide whether to approve SPJV's application for hydrologic testing as proposed, approve with modifications, or deny the permit as required by the metalliferous mineral leases issued by Trust Land Management Division's Minerals Management Bureau.

The Montana Board of Land Commissioners and the Department of Natural Resources and Conservation occupy a fiduciary position with respect to all school trust lands. The Enabling Act (The Act of February 22, 1889, 25 Stat. 676) and the 1972 Montana Constitution charge the Board with the obligation of highest trust and responsibility to manage these lands to produce revenue to support the various trust purposes set out in the Enabling Act.

Pursuant to Article X, Section 4, of the 1972 Montana Constitution the Board of Land Commissioners is the trustee over the administration of these trust lands. Section 77-1-202, MCA describes the powers and duties of the board.

> 77-1-202. Powers and duties of the board. (1) The board shall exercise general authority, direction, and control over the care, management, and disposition of state lands and subject to the investment authority of the board of investments, the funds arising from the leasing, use, sale, and disposition of those lands or otherwise coming under its administration. In the exercise of these powers, the guiding rule and principle is that these lands and funds are held in trust for the support of education and for the attainment of other worthy objects helpful to the well-being of the people of this state as provided in the Enabling Act. The board shall administer this trust to secure the largest measure of legitimate and reasonable advantage to the state.

Under Section 77-1-301, MCA, the Department of Natural Resources and Conservation is granted the day-to-day management of these lands.

Pursuant to Article X, Section 4 of the State Constitution, the Board of Land Commissioners "... has the authority to direct, control, (and) lease..." school lands which have been granted for the support and benefit of the various educational institutions. Under the authority of 77-3-101, et seq., MCA, the Board issued Metalliferous Mining Leases No. M-1715-86 and M-1717-86 and the leases were subsequently acquired by the Seven-Up Pete Joint Venture (SPJV).

Under the terms of these leases, the lessee must submit to the Department (DNRC) an operating plan for its review and approval before conducting any exploration, mining, or milling activities on the leased premises. The leases require the State's mineral lessee to fully comply with all applicable state and federal laws, rules and regulations, including but not limited to those concerning safety, environmental protection, and reclamation. These terms also require the lessee to conduct and reclaim the operation in accordance with the performance and reclamation standards of applicable mine reclamation laws.

Surface activity may be denied on all or portions of any tract, if the Department determines, in writing, after an opportunity for an informal hearing with the lessee,

that the proposed surface activity will be detrimental to trust resources and is therefore not in the best interest of the School Trust.

H. The Permitting Process

The Montana Environmental Policy Act (MEPA) is a State law which directs DEQ and DNRC to disclose effects of proposed activities on private and State lands to the public and officials making decisions concerning the proposal. The MEPA process began when SPJV submitted a work plan on February 27, 1997 to conduct water well tests.

Under MEPA, issues and alternatives are developed based on both public and agency input. These issues are then tracked through the environmental analysis phase of the document. The deciding officials review the alternatives and weigh the opportunities, tradeoffs, positive and negative impacts, and come to a decision.

Since the proposed water well tests will be conducted as an activity approved under Exploration License No. 00497, MCA 75-5-401(5)(j) provides that no MGWPCS permit is required for reinfiltration to groundwater of the water produced by the pumping wells during the tests. The proposed discharges to groundwater from water well tests are categorically excluded from nondegradation review and approval and are a nonsignificant activity under MCA 75-5-317(2)(j). In addition, Section 75-5-317(2)(p) excludes exploration activities from nondegradation review.

CHAPTER II

PROPOSED PLAN AND ALTERNATIVES

A. Proposed Plan

The six wells listed below would be pumped during the tests with the indicated expected ranges of pumping rates. The range is determined from the pumping rates achieved in previous tests. The upper end of each range is the maximum pumping rate that would occur during the test.

- Tuff dewatering well WW-93-005 (400-500 gpm)
- Blackfoot Valley cut-off well WW-93-004 (500-600 gpm)
- Landers Fork Valley cut-off well WW-93-006 (300-400 gpm)
- shallow TVS-upper dewatering well WW-92-001 (75-200 gpm)
- deep TVS-upper dewatering well WW-96-007 (100-200 gpm)
- deep TVS-upper dewatering well WW-96-008 (10-50 gpm)

The total pumping rate from all six wells combined would not exceed 1,950 gpm. The location of the test wells is shown on Figure 1.

The Landers Fork Valley Infiltration Site #1 (Figure 1) would be about 25 feet in width at its base and have a total length of about 270 feet. The trench would be oriented approximately north-south parallel with the gradient. It would be approximately 10 feet in depth with sideslopes of about 2:1. The trench would have two compartments. The lined upgradient compartment would serve as a settling pond where metal precipitates are expected to collect. The Landers Fork Infiltration site #1 would have four 2-2.5 inch shallow piezometers surrounding the infiltration area installed to 10 feet below the water table and staff gauges to measure water depths in each compartment.

The downgradient Blackfoot Valley Infiltration Site #2 (Figure 1) would be

about 25 feet in width at its base and have a total length of about 140 feet. The trench would be approximately 10 feet in depth with side slopes of about 2:1. The site would have four 2-2.5 inch shallow piezometers surrounding the trench installed to 10 feet below the water table, and a staff gauge to measure the water depth.

The test would include simultaneous infiltration of pumped water into the Blackfoot Valley alluvium near the silicified zone in the underlying tuffs (Infiltration Site #3). The upgradient Blackfoot Valley Infiltration Site (Figure 1) would be about 25 feet in width at its base and have a total length of about 100 feet. The trench would be approximately 10 feet in depth with side slopes of about 2:1. The site would have two 2-2.5 inch shallow piezometers on the south and west side of the trench installed to 15 feet below the water table, and a staff gauge to measure the water depth.

Drawdown in the alluvium in response to pumping the cut-off wells in the Blackfoot and Landers Fork valleys has previously been examined. The limited drawdown in the alluvium is produced by leakage from the base of the alluvium into the underlying tuffs, and the rate of leakage is considered to be limited by the vertical hydraulic conductivity of the zone where leakage occurs.

In the 1997 test, locating an infiltration site near the Blackfoot Valley silicified zone would help to offset drawdown in the alluvium. It is predicted that some groundwater mounding would occur due to infiltration. The 1997 test would allow observations to be made as to whether the rate of leakage and the efficiencies of the cut-off wells may vary in response to local changes produced by infiltration mounding. The rate of leakage to the cut-off wells would be determined from both drawdown/mounding measurements in the alluvium, and drawdown measurements in the underlying tuffs in the silicified zones.

It is planned that the 1997 test would utilize one discharge pipeline circuit connecting three test wells to two infiltration areas in the Blackfoot Valley, and pipelines connecting the three remaining test wells to a single infiltration area in the Landers Fork Valley, as illustrated on Figure 1. Discharge water would be piped to the infiltration areas through appropriately sized pipelines. The infiltration discharge areas are located outside of the 100-year floodplain.

Pilot scale testing of water pre-treatment would be carried out. This testing would be designed to promote the spontaneous precipitation and concentration reductions observed in the 1995 test in the Blackfoot Valley. A number of options for oxidation, settlement, and/or filtration in one or more of the infiltration sites are being considered. Geochemical modeling of the discharge chemistry during pre-treatment is described in the attached statement of basis.

B. Alternatives to the Proposed Plan

1. Alternative 1 - No Action

Under this alternative the hydrological testing would be denied, and no pumping or additional disturbances would take place.

C. Alternatives Evaluated but Dropped from Further Consideration

The only other alternative considered (in addition to the *no action* alternative) was one that allowed only a portion of the requested pumping rates and longevity. However, this alternative was rejected since it would not provide the level or magnitude of information sought under the proposed action.

CHAPTER III

AFFECTED ENVIRONMENT

A. Soils and Vegetation

The upland areas are covered with a blanket of glacial till that ranges in thickness from one to 8 feet. Soils formed on the floodplains and terraces are gravelly loams. Soils in the area possess no physical or chemical limitations to their use for reclamation and there are adequate soil volumes present throughout the project area to perform successful reclamation.

Vegetation in the area is predominantly coniferous forest interspersed with native grasslands on the uplands and sagebrush on the alluvial terraces. No sensitive, rare, or unique plant species were identified in the vegetation inventory.

B. Hydrology

1. Surface Water

The Blackfoot River originates at the confluence of Beartrap and Anaconda Creeks approximately 12 miles up gradient from the McDonald Project. The portion of the Blackfoot drainage that runs past the project area and downstream to Lincoln is generally referred to as the Upper Blackfoot System. Although the Blackfoot River is recognized as a major perennial stream, it is characterized by alternate gaining and losing reaches. Immediately downstream from the project area, the entire flow infiltrates into the valley alluvium during low-flow periods, and sections of the river can be completely dry for up to 3 miles.

Water quality in the Blackfoot River and its tributaries varies widely, but is generally considered to be good. Throughout the entire basin, the mainstream and tributaries are classified as B-1 in the Montana Surface Water Quality Standards. Peak discharges usually occur in May and June in response to both snowmelt and precipitation events. Low-flow and baseflow conditions occur in late fall and winter.

The major surface water resources near the project area are the Blackfoot River and Landers Fork, a tributary to the Blackfoot. Other tributaries include Alice Creek,

Copper Creek, Hardscrabble Creek, and Hogum Creek. There are several small intermittent to ephemeral drainages in the project area. Ten springs/seeps are identified in this area.

In the Upper Blackfoot River basin, changes in the natural hydrochemistry have occurred due to historic mining at the headwaters. Many of these changes have occurred since the failure of a tailings dam and rechanneling of the river in the headwater area of the Blackfoot River in 1975.

In the Blackfoot River, the major cations and anions are dominated by calcium, magnesium and bicarbonate. The Blackfoot water pH is typically between 7.4 and 8.6. Most trace metals are below detection limits except copper, cadmium, iron, aluminum, manganese, and zinc. These elements follow a trend of general increase with increasing flow and decrease in a downstream direction. Most metals are associated with suspended sediments, which increase with increasing flow.

Like the Blackfoot River, the hydrochemistry of the Landers Fork is dominated by calcium, magnesium, and bicarbonate. Water pH typically ranges between 8.0 and 8.3. Most trace elements are below detectable limits except for zinc, copper, iron, aluminum, and manganese that appear to increase with increasing flow. Landers Fork is generally lower in metal concentrations than the Blackfoot River.

Additional information on surface waters are contained in SPJV's application for an operating permit.

2. Groundwater

Locally, all the geologic units contain groundwater, but the capacity to store and transmit water varies. The alluvial deposits in the Blackfoot and Landers Fork valleys form the main aquifers in the area. However, groundwater movement is significant in several bedrock units, particularly the silicified zones within the bedrock units hosting the McDonald deposit. Each of these geologic units has an influence on potential pit dewatering and water management in the project area.

In general, groundwater flows from areas of topographic highs in the area of the deposit to the main valley floors, mirroring the topography. Groundwater recharge in the project area is derived solely from precipitation and infiltration. There is currently no evidence for recharge from regional groundwater flow. Groundwater

flow in the alluvial aquifers occurs in the same general direction as the surface water flow in each valley. In the area around the project, the Landers Fork has gaining and losing reaches and the Blackfoot River generally loses except for certain reaches where the river is recharged from bank storage during the late spring. Current studies have established that some losing reaches of both the Blackfoot River and the Landers Fork become totally dry during certain periods of the year. The volume of recharge and discharge to the rivers varies seasonally.

Most of the groundwater chemistry (water derived from alluvium; water derived from the project area volcanic bedrock; and water derived from the Precambrian bedrock) is classified as calcium-magnesium-bicarbonate dominated. Two out of eighteen groundwater sample sites are classified as sodium bicarbonate and sulfate dominant. Sulfate and arsenic concentrations are elevated in the region of the McDonald ore deposit, relative to the surrounding sites. The Landers Fork and Blackfoot River aquifers are very similar in water quality.

Field pH values ranged from 6.5 to 7.0 in the central area of the deposit to 7.2 to 8.1 in the alluvium and peripheral areas. The pH values were slightly higher in the Landers Fork wells (7.5-8.1) than in the Blackfoot River wells (7.2-7.5).

Most of the wells in the project area show low water levels between December and March and high water levels in May. Seasonal fluctuations in the Blackfoot alluvial wells range from 5-20 feet, while seasonal changes in Landers Fork alluvial wells range from 5 to over 50 feet. Seasonal fluctuations in bedrock wells range from less than 2 feet to 17 feet. No temporal trends in hydrochemical data are apparent.

An old, abandoned county landfill site is located approximately 500 feet northwest of infiltration site #2. The landfill is situated above the water table, on till and intermixed till and alluvium near the confluence of the Blackfoot River alluvial valley with the Landers Fork alluvial valley. The proposed infiltration trenches would be placed in alluvium. Volatile organic analysis of water from two monitoring wells taken since 1992 indicates no contaminated groundwater downgradient of the landfill.

Additional information on groundwater is contained in SPJV's application for an operating permit.

C. Wildlife and Fisheries

Stream channel conditions in the Blackfoot and Landers Fork within the project area are mostly eroded and unstable which result in poor habitat conditions for fish. Eight species of fish live in the Blackfoot and five species live in the Landers Fork. Bull trout and west slope cutthroat trout are considered species of special concern. Densities of these species are quite low in both rivers. In 1994, the U.S. Fish & Wildlife Service determined that there may be sufficient justification for listing the bull trout as an endangered species. Tracking of radio-tagged bull trout indicates that they use both rivers as migration corridors, but do not spawn in the vicinity of the project site. Bull trout spawning in the Blackfoot River basin takes place during late August and September. Fisheries surveys conducted in 1996 found 39 bull trout redds in the upper Blackfoot River basin, however, none were found in the Landers Fork and none were found in the Blackfoot River in the vicinity of the McDonald project. These results are consistent with previous surveys conducted by the U.S. Forest Service.

In 1996 and 1997, SPJV funded a study of the Hyporheic zone associated with the Blackfoot and Landers Fork Rivers in the vicinity of the proposed McDonald Gold Project. The Hyporheic zone is the saturated region adjacent to streams where water freely exchanges with the channel. The ecological significance of this zone has only recently been recognized. Biological and physical analyses of freeze cores collected from six river bottom locations indicate that invertebrate densities decline from greater than 135 individuals within the first ten centimeters to less than 8 individuals at 0.6 meters beneath the surface. Likewise the number of species declines rapidly below the first ten centimeters.

Wells were also sampled for invertebrate analysis. Six wells were located 5 to 10 meters away from the channel and extended about 6 meters into the saturated zone. Invertebrate densities ranged from 0 to 14 individuals per 60 liters of groundwater and the number of species ranged between 0 and 10. The presence of stoneflies in many of the wells suggests that these invertebrates may be present at locations farther than 10 meters from the rivers.

The most important wildlife species of concern at the McDonald project site is elk. Part of the property is used as elk winter range and some elk remain in the area during the spring to calve.

D. Cultural Resources

A cultural resource inventory identified ten historic sites and five prehistoric sites within the McDonald project area. Presently not all of the sites have been evaluated. However, the Cokahlarishkit trail and the historic road grade have been determined to be eligible for listing on the National Register of Historic Places.

For the 1997 hydrologic field investigation proposal, pipelines are proposed to cross Section 6, T14N, R7W in the vicinity of log ramps (24LC1088). Pipelines are also proposed to cross a historic road grade (24LC1089). In addition test infiltration trench #2, monitoring wells for this site, and a temporary access route are proposed in the vicinity of the Cokahlarishkit camp (24LC1210).

CHAPTER IV

ENVIRONMENTAL CONSEQUENCES

A. Effects on Soils and Vegetation

1. Proposed Action

Disturbances for well sites, roads, pipeline, and infiltration trenches are covered under the umbrella of the total disturbance addressed in the 1992 Exploration EA. The trenches would be excavated with an excavator and/or bulldozer. All soils would be salvaged and stockpiled for subsequent replacement during reclamation. Metals, etc. precipitated from solution would be removed from the infiltration trenches and properly disposed of after completion of the tests. For reclamation, the trenches would be backfilled, recontoured, and seeded for revegetation. Improvements and equipment would be removed from the site unless otherwise authorized.

A maximum total of 1,950 gallons of water per minute would be delivered to the infiltration trenches through the pipelines. The potential may exist for leakage, either accidentally or as a result of vandalism. Such an occurrence could possibly result in erosion. Monitoring for leaks would be required to detect problem areas in their early stages. SPJV is proposing to use HDPE (high-density polyethylene) pipe for the 1997 tests. HDPE pipe, as opposed to the standard aluminum irrigation pipe used in previous years, is considerably stronger, has a much higher pressure rating, comes in longer lengths resulting in fewer joints, and is heat-welded together to form strong and tight seals between pipe lengths. The improved pipeline design would result in an un-pressured flow condition, reducing the erosiveness and volume of possible leaks. Should a leak be detected, the appropriate pumps would be shut down, the entire pipeline would be closely inspected for failure, and the necessary repairs would be made. If such an incident occurs, SPJV would be required to contact the DEQ and DNRC, Clearwater Unit office within 24 hours to discuss the situation and determine appropriate reclamation.

It should be noted that a small pipeline rupture occurred during the 1996 pump tests. The associated loss in pressure was quickly detected by SPJV personnel, the pump was shut down, the location of the leak was found by walking the irrigation pipeline, and the length of pipe was replaced. The erosional damage to the ground

was minimal, consisting of a small diameter hole about 3 feet deep.

Because the six wells proposed for pumping and associated roads and power lines already exist, there will be no new drilling disturbances. Additional surface disturbance would be required for monitoring well installation, excavation of infiltration trenches and access routes. Reclamation for all disturbances including revegetation of the trench sites, access roads, and the drill sites would be in accordance with the MMRA, SPJV's reclamation plan, and provisions covered in the 1992 Exploration EA and the 1996 Hydrological Investigations EA. Approximately 1 to 2 acres would be temporarily disturbed during the pump test and then reclaimed when the test is completed. Construction of the infiltration trenches, drilling of monitoring wells around the trenches, and construction of the pipelines and access roads would require cutting of trees. Requirements for timber removal on state land are described in the 1996 Hydrological Investigations EA.

2. No-Action Alternative

Under the no action alternative, the hydrological testing would not proceed and no impacts to soils or vegetation would occur.

B. Effects on Hydrology

1. Surface Water

a. Proposed Action

The water quality or flow regime of Blackfoot River and the Landers Fork would not be affected by the proposed action. The infiltration sites have been located so that groundwater containing infiltrated water does not discharge to any surface water body. The infiltration trenches would be located outside the 100-year flood plain to avoid erosion or impact to surface water. No wetlands would be impacted by the proposal.

An important result of the 1995 and 1996 hydrological tests is the fact that there were no observed increases in metals concentrations over baseline conditions in the Blackfoot River or Landers Fork as a result of discharging pumped water into infiltration trenches in the alluvial aquifers. Therefore, the mixing zone analysis methodology used in this EA is considered reliable and appropriately conservative.

Additional technical details regarding hydrologic analysis of the company's proposal and mixing zones, along with monitoring and contingency plans, are provided in the attached Statement of Basis.

b. No-Action Alternative

Under the no action alternative, the hydrological testing would not proceed and no impacts to surface water would occur.

2. Groundwater

a. Proposed Action

Based on modeling of chemical parameters of potential concern, discharge of the pumped water to the alluvial groundwater in the Blackfoot and Landers Fork Valleys would not cause exceedences of human health or aquatic life standards outside of the designated groundwater mixing zones. The project would not impact any biologically important areas, drinking water, or recreational activities. In addition, no impacts to springs or surface water quantity are anticipated. A monitoring program has been developed for groundwater and surface water resources.

An important result of the 1995 and 1996 hydrological tests is the fact that there were no observed increases in groundwater metals concentrations over baseline conditions outside of the designated mixing zones as a result of discharging pumped water into infiltration trenches in the alluvial aquifers. Therefore, the mixing zone analysis methodology used in this EA is considered reliable and appropriately conservative.

Additional technical details regarding hydrologic analysis of the company's proposal and the mixing zones, along with monitoring and contingency plans, are provided in the attached Statement of Basis.

As discussed in Chapter III, an old, abandoned county landfill exists approximately 500 feet northwest of proposed infiltration site #2. Initially, some concern was expressed by agency personnel regarding the potential of the infiltration water to cause localized mounding of the water table up into the landfill, as well as the possibility of the infiltration water accelerating the flow of any contamination plume that may be located below the landfill. Analysis of groundwater from monitoring

wells adjacent to the landfill indicate that no contaminant plume exists in the landfill area. Considering the volumes of proposed infiltration discharges compared to baseline (mean flow) underflows in each valley, the agencies do not expect that significant local mounding of the water table would extend from the infiltration sites into the landfill area. Therefore, baseline groundwater flow paths in the alluvial aquifer beneath the landfill should not be affected by the infiltration discharges. Similarly, no significant changes to the groundwater flowpaths near the landfill are simulated with the numerical groundwater model, described in Appendix E of the plan of operations.

The numerical model indicates that there may be some increase in the elevation of the water table, together with an increase in the overall hydraulic gradient in each valley. Based upon flow volume considerations and the numerical model results, the increase in the elevation of the water table at the nearest monitor well (MW-92-017) is estimated to be less than 3 feet, and the increase in hydraulic gradients to be less than 5 to 15 percent. Since these estimated changes are similar to the range of seasonal variations at MW-92-017, the proposed water well and infiltration tests should not produce any unusual condition in the aquifer beneath the nearby landfill.

b. No-Action Alternative

Under the no action alternative, the hydrological testing would not proceed and no impacts to groundwater would occur.

C. Effects on Wildlife and Fisheries

1. Proposed Action

The pump tests scheduled for the summer and fall of 1997 would not involve any discharges to surface water. The infiltration galleries have been located so that there would not be discharge of any infiltrated water to gaining stream reaches. Because no changes to surface water quality or quantity would occur as a result of this action, there would be no impacts to rearing and migratory behavior of bull trout or west slope cutthroat trout. Aquatic and riparian habitat would not be disturbed because pipes, wells, and infiltration trenches would be far removed from these areas.

The 1997 pump tests are unlikely to impact the Hyporheic life and habitat of the Blackfoot and Landers Fork rivers. The locations of the infiltration trenches have been chosen to preclude infiltrated water from migrating near any surface water body. Analysis of groundwater downgradient from the 1996 and 1995 infiltration trenches shows that the concentrations of important parameters did not change. Organisms may be present at distances further away from the rivers than has been sampled and could be present within the designated mixing zones. However, since previous studies have demonstrated that groundwater quality is not impacted by the pump tests, the organisms present in these areas are unlikely to be affected.

No impacts to wildlife are expected to occur from removal of vegetative cover for this proposal. The amount of timber removed for installation of the infiltration trenches and pipelines falls within the amount of disturbance covered by the 1992 Exploration EA. The hydrologic field investigations are proposed for July through December as weather and other site conditions permit. Exploration activity in Section 6, T14N, R7W is restricted from December 1 through May 15 due to elk displacement concerns. The activity in Section 6, T14N, R7W involves pipeline placement. The pipeline would be emplaced prior to December. No new activities are proposed for Section 6 during December. Pipeline drainage or removal for reclamation would be handled within the activity limits outlined in the 1992 Exploration EA, if necessary from December 1 to May 15, or would be conducted at an alternative time. Therefore, there would be no impacts to elk with regards to displacement concerns. Fencing would be required to prevent wildlife access to the infiltration trenches.

2. No-Action Alternative

Under the no action alternative, the hydrological testing would not proceed and no impacts to wildlife or fisheries would occur.

D. Effects on Cultural Resources

1. Proposed Action

Placement of pipelines and temporary access routes would cause minimal ground disturbance. No cultural resource sites on state lands would be impacted with placement of pipelines or access routes. Specific routes and boundaries for the proposed action would be flagged to avoid areas of concern. Roads currently present would be used to access test infiltration trenches #1 and #3.

During April 24 and 25, 1997, Ethos Consultants, Inc. conducted an inventory of cultural resources of an area in the SE¼ of Section 12, T14N, R8W that would fully contain disturbances associated with the proposed action in this location. No cultural resources were identified within the area inspected. Therefore, it is unlikely that cultural resources will be impacted by the construction of the test infiltration trench #2, and any associated groundwater test wells.

The U. S. Army Corps of Engineers did not find any cultural resource impacts for the proposed action according to their letter to the Montana Historical Society - State Historic Preservation Office, dated April 21, 1997.

2. No-Action Alternative

Under the no action alternative, the hydrological testing would not proceed and no impacts to cultural resources would occur.

E. Private Property Impacts

No restrictions would be imposed on SPJV's use of private property as a result of this regulatory action.

F. Public Health and Safety

The infiltration trenches would be required to be fenced and signed as "off limits to the public" to provide for public safety. This fencing would be removed upon reclamation of the trenches. Pipeline on state land would be routed through culverts or buried beneath roads where crossings are needed. This would prevent limiting access to the tracts for land management and fire suppression activities. The accompanying Statement of Basis notes that no domestic wells are within or near the designated mixing zone. The mixing zone analysis demonstrates that beneficial uses would not be impaired for downstream groundwater or surface water users. Activities in state-owned Section 12, T14N, R8W would be coordinated with state cabin site lessees, as needed, so as to not unreasonably interfere with residential uses.

CHAPTER V

CUMULATIVE EFFECTS

A prodigious amount of data was collected by both the company and the DEQ during (and following) the 1995 and 1996 hydrological tests. This data has demonstrated that no measurable increases in groundwater or surface water metals concentrations over baseline conditions occurred outside of the designated mixing zones as a result of discharging pumped water into infiltration trenches in the alluvial aquifers. In fact, the trace amount of metals present in the discharge water did not migrate more than a few hundred feet from the infiltration trenches. Therefore, the mixing zone analysis methodology used in this EA is considered reliable and appropriately conservative.

All available data indicates that no measurable impacts have occurred as the result of past hydrological testing in this area. Therefore, no cumulative effects exist.

It is anticipated that an application to place a fiber optic line across state land in Section 12, T14 N, R8W may be submitted in the near future. If submitted, the applicant and SPJV would coordinate to find an acceptable location for the line to minimize conflicts with the hydrologic testing and potential future mine facilities.

CHAPTER VI

CONCLUSIONS

The analysis presented in this EA and in the attached Statement of Basis concludes that the proposed pumping and infiltration of water into the alluvium of the Blackfoot and Landers Fork Valleys would not cause impact on groundwater outside of the designated mixing zones, and that infiltrated water would not discharge to surface water. Furthermore, experience from the 1995 and 1996 pump tests indicates that most metals in the pumped water would precipitate out on the bottom of the trenches and would not migrate into the underlying aquifer.

CHAPTER VII

CONSULTATION AND COORDINATION

This EA is a joint document prepared by the Department of Environmental Quality and the Department of Natural Resources and Conservation.

The Army Corp of Engineers was consulted in Preparation of this document.

A public notice was published in the Blackfoot Valley Dispatch, Lincoln , MT and the Missoulian, Missoula, MT the week of May 12, 1997, requesting written comments by June 6, 1997.

Individuals involved in preparation were:

Department of Environmental Quality

Joe Gurrieri	Groundwater and Surface Water Hydrology, Aquatic Biology
Laura Kuzel	Geochemistry
Scott Spano	Exploration
Warren McCullough	Exploration

Department of Natural Resources & Conservation

Teresa Kinley	Geology/Hydrology
Monte Mason	Trust Land Responsibilities
Patrick Rennie	Cultural Resources

REFERENCES CITED

Montana Department of State Lands, 1992, Environmental Assessment, Seven-Up Pete Joint Venture, McDonald Gold Exploration Project.

Montana Department of Environmental Quality and Department of Natural Resources & Conservation, 1996, Final Environmental Assessment, Seven-Up Pete Joint Venture, McDonald Gold Exploration Project, 1996 Hydrologic Field Investigations, July 1996.

Seven-Up Pete Joint Venture, 1997, Work Plan for 1997 Extended Water Well Tests.

GLOSSARY

Adsorption	Adhesion of molecules in solution to solids with which they are in contact.
Concentration	Amount of material contained in a specified volume, or the strength of a solution (mass per volume).
Cut-off wells	Dewatering wells located in the more permeable silicified bedrock zones and designed to prevent alluvial groundwater from entering the proposed pit.
DEQ	Montana Department of Environmental Quality
Dewatering	Pumping of groundwater for the purpose of drawing down the water table.
Dispersion	The spread of constituents in an aquifer.
DNRC	Montana Department of Natural Resources and Conservation
EA	Environmental Assessment - an environmental document of a proposed action and its effects on the environment
EIS	Environmental Impact Statement - a comprehensive environmental document delineating a proposed action's effects on natural and human environment. An EIS gives an in-depth look at specific issues and cumulative effects in an area.
Ferrihydrite	Iron oxide mineral important in adsorption of metal ions.
Gaining Stream	A stream that receives water from the underlying aquifer; its channel lies below the water table.
Gpm	Gallons per minute
Hydraulic Conductivity	The relative ease with which water flows through aquifer materials.
Losing Stream	A stream that contributes water to the underlying aquifer; its channel lies above the water table.
MMRA	Montana Metal Mine Reclamation Act
Permeable	A relative property of material that allows for movement of water. Low permeability of impervious material such as clay would allow less water movement than the high permeability of a pervious medium such as sand or gravel.
Piezometer	Small diameter well used for measuring water table elevation.

Potentiometric Surface	A surface representing the level to which water will rise in a well, (e.g. water table).
Precipitates	Iron or manganese oxides.
Redds	Trout spawning beds.
Silicified Zone	A zone of brittle, fractured, and permeable rocks in the McDonald deposit.
Source-Specific Mixing Zone	A site specific volume of an aquifer where initial dilution of a discharge takes place and where certain water quality standards may be exceeded. Designated if a standard mixing zone is not applicable.
Standard Mixing Zone	A standard size volume of an aquifer where initial dilution of a discharge takes place and where certain water quality standards may be exceeded. Requires less data collection and demonstration than required for a source specific mixing zone.
Tracer	A substance that is used in a process to trace its course.
Tuff	Volcanic ash material that has been consolidated into a solid rock unit. The tuff unit outcrops within the McDonald deposit.
TVS-Upper	A rock unit containing consolidated Tertiary volcanic sediment and outcrops on the north side of the McDonald deposit.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

Exploration License No. 00497

STATEMENT OF BASIS

(for proposed groundwater mixing zones)

PERMITTEE: Seven-Up Pete Joint Venture

RECEIVING WATERS: Blackfoot River Alluvial Aquifer and Landers Fork Alluvial Aquifer

FACILITY LOCATION: Lewis and Clark County, T14N, R8W, Sections 1 and 12; T14N, R7W, Sections 5, 6, and 7

A. PROPOSED ACTIVITY

Seven-Up Pete Joint Venture (SPJV) proposes to conduct a pump test at the proposed McDonald Project site to provide hydrologic and hydrochemical information for the Venture's mine proposal near Lincoln, Montana. The proposal calls for conducting long-term water well tests scheduled to begin in the Summer of 1997. The tests proposed are focused on the two major bedrock units (Upper TVS and tuff). Six existing wells located in the vicinity of the proposed mine pit would be pumped and the water discharged into two infiltration trenches in the Blackfoot aquifer and one infiltration trench in the Landers Fork aquifer (Fig 1). Pumping is scheduled to begin in June 1997 and continue through December as weather and other site conditions permit.

B. MIXING ZONE DESIGNATION

The well testing requires discharge at 3 infiltration points, one in the valley alluvium of the Landers Fork, a tributary to the Blackfoot River and two in the valley alluvium of the Blackfoot River. Specifications are presented for boundaries, dimensions and rationale for source specific mixing zones downgradient of the infiltration points which

will satisfy requirements of MCA 75-5-301 (4) and ARM 17.30.501 through 17.30.518. Additional analysis is presented to address compliance with more restrictive surface water standards.

The location of infiltration site #1 in the Landers Fork Valley is indicated in Figure 1. Hydrologic features important for predicting mixing and migration of infiltrated water are:

- In the area of the infiltration trench, the saturated thickness of the alluvium is about 60 to 70 ft. To the south, the saturated thickness of the alluvium stays the same or increases by about 10 ft. Drill holes in the area show no evidence of low hydraulic conductivity layers in the saturated alluvium.

- The Landers Fork is a losing stream in the vicinity of the infiltration trench and mixing zone. A short gaining reach exists up gradient from the trench in the vicinity of surface water monitoring station SW-44.L, however, the Landers Fork infiltration site is at a location where there is no likely groundwater flow path to known or inferred gaining portions of the rivers.

- The potentiometric surface configuration indicates generally southward groundwater flow that parallels the Landers Fork. The water discharged to the infiltration trench would mix with alluvial groundwater while flowing down the valley parallel to the Landers Fork.

- A hydraulic conductivity of 750 ft/day was used for the Landers Fork aquifer. It is estimated that an average of 200-400 days would be required for the infiltrated water to travel from the infiltration trench to the end of the mixing zone.

The location of infiltration site #2 in the Blackfoot Valley is indicated in Figure 1. Hydrologic features important for predicting mixing and migration of infiltrated water are:

- In the area of the infiltration trench, the saturated thickness of the alluvium is about 70 to 80 ft, and continuously increases downgradient. Drill holes in the

area show no evidence of low hydraulic conductivity layers in the saturated alluvium.

- The Blackfoot River is a losing stream in the vicinity of the infiltration trench and mixing zone during the time of year that the pump test is proposed (summer, fall, and winter). Infiltration site #2 is at a location where there is no likely groundwater flow path to known or inferred gaining portions of the rivers. Groundwater does not discharge to the Blackfoot River until the river passes through the Blackfoot canyon, 3 to 6 miles west of Lincoln.

- The potentiometric surface configuration indicates generally southwestward groundwater flow that parallels the Blackfoot River. The water discharged to the infiltration trench would mix with alluvial groundwater while flowing down the valley parallel to the Blackfoot River.

- A hydraulic conductivity of 1200 ft/day was used for the Blackfoot aquifer. It is estimated that an average of 100-200 days would be required for the infiltrated water to travel from the infiltration trench to the end of the mixing zone.

The location of infiltration site #3 in the Blackfoot Valley is indicated in Figure 1. Hydrologic features important for predicting mixing and migration of infiltrated water are:

- In the area of the infiltration trench, the saturated thickness of the alluvium is about 40 to 50 feet and does not change appreciably downgradient. Drill holes in the area show no evidence of low hydraulic conductivity layers in the saturated alluvium.

- The Blackfoot River is a losing stream in the vicinity of the infiltration trench and mixing zone. Infiltration site #3 is at a location where there is no likely groundwater flow path to known or inferred gaining portions of the rivers. Groundwater does not discharge to the Blackfoot River until the river passes through the Blackfoot canyon, 3 to 6 miles west of Lincoln.

- The potentiometric surface configuration indicates generally southwestward groundwater flow that parallels the Blackfoot River. The water discharged to the infiltration trench would mix with alluvial groundwater while flowing down the valley parallel to the Blackfoot River.

- A hydraulic conductivity of 1200 ft/day was used for the Blackfoot aquifer. It is estimated that an average of 230-340 days would be required for the infiltrated water to travel from the infiltration trench to the end of the mixing zone.

The expected chemistry of the groundwater pumped from the proposed water wells (Table 1) is based on results of water samples from previous pump tests. All of the six wells have previously been pumped. Average values are used to establish expected wellhead chemistry for all proposed pumping wells except well WW-96-008 where maximum values were used because of the few number of samples available (4 samples). While the use of maximum values for well WW-96-008 results in a slightly larger mixing zone, a conservative analysis is preferred that attempts to strike a balance between water quality protection and designation of a mixing zone that is of the "smallest practicable size" as required in ARM 17.30.518 (5)(I). The concentration of certain parameters may be higher at certain times during the test and particularly for the first few days of pumping.

Where the maximum concentration in the infiltration water (Table 1) equals or exceeds the groundwater/surface water standards listed in Table 2, and the discharge concentration is greater than the ambient concentration in the receiving water (Table 2), the discharge is considered to be of potential concern for that constituent. Based on the maximum chemical concentrations in the infiltration water, the following are constituents of potential concern: antimony, arsenic, iron, manganese, and thallium.

Table 1. MINTEQA2 Modeling of Expected Infiltration Water Quality.

Blackfoot Sites #1 and #2

Constituent	MINTEQA2[1] input (mg/L)	MINTEQA2 OUTPUT Dissolved[2] (mg/L)	Precipitated[3] (mg/L)	Sorbed into ferrihydrite (mg/L)	Percent Removed
Antimony	0.009	0.009	-	-	0
Arsenic	0.014	0.005	-	0.009	64
Iron	1.690	<0.001	1.690	-	100
Manganese	0.189	0.189	-	-	0
Thallium	0.004	0.004	-	-	0

Landers Fork Site #1.

Constituent	MINTEQA2[1] input (mg/L)	MINTEQA2 OUTPUT Dissolved[2] (mg/L)	Precipitated[3] (mg/L)	Sorbed into ferrihydrite (mg/L)	Percent Removed
Antimony	0.010	0.010	-	-	0
Arsenic	0.038	0.020	-	0.018	47
Iron	1.374	0.001	1.372	-	100
Manganese	0.172	0.172	-	-	0
Thallium	0.004	0.004	-	-	0

[1]Expected chemistry of groundwater pumped from water wells.
[2]Maximum concentration in infiltration water. These values are used for mixing zone calculations in Table 2.
[3]Removed from the dissolved phase due to formation of one or more mineral phases.

Table 2. Concentration reduction calculations for Source Specific Mixing Zone.

Blackfoot Sites #1 and #2

Parameter	Units	Infiltration Water (MINTEQA2 output)[2]	Blackfoot alluvial groundwater[1]	At boundary of mixing zone[3]	Groundwater[4] Standard	Aquatic[4] Standard
Antimony	mg/L	0.009	0.0015	0.003	0.006	NS
Arsenic	mg/L	0.005	0.003	0.004	0.018	0.190
Iron (total)	mg/L	<0.001	0.014	0.014	0.3	1.0
Manganese	mg/L	0.189	0.0027	0.035	0.05	NS
Thallium	mg/L	0.004	0.001	0.00168	0.0017	NS

Landers Fork Site #1.

Parameter	Units	Infiltration Water (MINTEQA2 output)[2]	Landers Fork alluvial groundwater[1]	At boundary of mixing zone[3]	Groundwater[4] Standard	Aquatic[4] Standard
Antimony	mg/L	0.010	0.0015	0.003	0.006	NS
Arsenic	mg/L	0.020	0.003	0.006	0.018	0.190
Iron (total)	mg/L	0.001	0.011	0.011	0.3	1.0
Manganese	mg/L	0.172	0.0025	0.032	0.05	NS
Thallium	mg/L	0.004	0.001	0.00168	0.0017	NS

[1]Maximum background concentrations in upstream and downstream receiving waters from Hydrochemistry Status Report, Appendix B.

[2]Dissolved concentration from MINTEQA2 model runs (Table 1).

[3]Calculations based on dilution to 17% of original concentration in discharge water added to the receiving water concentration.

[4]From WQB-7, Montana Numeric Water Quality Standards; NS = No Standard.

The commonly used EPA geochemical assessment model MINTEQA2 has been used to simulate chemical processes and changes in the infiltration water. The MINTEQA2 calculations simulate a new composition of the infiltration water after removal of material during chemical precipitation and sorption onto one of the precipitates (ferrihydrite). The output water from the MINTEQA2 calculations is then used to represent the composition

of the infiltration water that mixes with the Blackfoot and Landers Fork alluvial groundwater. The final dissolved chemical concentrations in the infiltration water, determined from the MINTEQA2 modeling are shown in Table 1.

Good field evidence for the processes modeled in MINTEQA2 is available from the 1995 infiltration test in the Blackfoot Valley alluvial aquifer. Data from the 1995 test indicates that sorption or precipitation appeared to remove all metals from the discharge water as it flowed into the infiltration trench and through the Blackfoot aquifer.

Based on the MINTEQA2 modeling, constituents requiring a mixing zone for dilution to groundwater standards are antimony, manganese, and thallium. The designated size of a standard mixing zone would not provide enough dilution to meet groundwater standards, therefore, a source-specific mixing zone will be designated. The MINTEQA2 modeling simulates the chemical precipitation and sorption that occur in the infiltration trench and in the alluvial aquifer. The observed reductions in metal concentrations near the infiltration trench during the 1995 water well tests in the Blackfoot River Valley indicate that the dimensions of the source specific mixing zone would provide more than enough area in which these processes may occur.

Transport modeling simulates dilution of higher concentration water discharged into lower concentration receiving water by the process of dispersion. Dispersion parameters govern the amount of spread of the plume in the transport model. The transport model calculates a plume in a 3-dimensional volume of the aquifer, where concentrations continuously decrease outward from the plume (Fig. 2). The sizes of the mixing zones are considered conservative because the additional retardation effect of natural attenuation mechanisms in the subsurface, which would cause the plume to be smaller, were ignored in the analysis. In reality, metals are reactive in the subsurface and attenuate readily, mainly through adsorption onto soil particles. Because the magnitude of, and mechanisms involved in retardation of metal transport in aquifers are difficult to predict and model with any accuracy, the mixing zones, as designated, are considered to be of the smallest practicable size.

The mixing zone for infiltration site #3 was determined using a three-dimensional continuous source analytical transport model by Domenico and Schwartz (1990)[1]. Dispersion parameters were determined from the ongoing tracer test begun in the Blackfoot Valley in 1995 and a point-source analytical transport model by Domenico and Schwartz

(1990)[1]. The three-dimensional size and configuration of the plume is based on where there is an appropriate reduction in concentration within the modeled continuous source plume after 120 days. This methodology will generate a mixing zone of the smallest practicable size.

Because the mixing zones from infiltration sites #1 and #2 merge together at the confluence of the two valleys, a different model was used to predict the shape and concentration contours for the combined mixing zones. The dimensions of the mixing zones for infiltration site #1 in the Landers Fork Valley and site #2 in the Blackfoot Valley were determined by constructing a numerical flow and transport model using MODFLOW, a modular flow model, and MT3D, a solute transport model (Fig. 3). The three-dimensional size and configuration of the plume was determined by calculating where there would be an appropriate reduction in concentration within the modeled plume to meet groundwater standards. Ten years was chosen to run all simulations to assure steady state. This methodology will generate a mixing zone of the smallest practicable size.

The models described above were used to delineate source specific mixing zone boundaries based on the amount of concentration reduction necessary for all constituents to be reduced to levels below the groundwater standard (Table 2). Antimony, manganese and thallium are the only constituents that exceed groundwater standards in the infiltration water and no constituents exceed aquatic life standards. The amount of dilution required to reduce the concentration of thallium to less than the groundwater standard (0.0017 mg/L) governs the size of the mixing zone. The estimate of concentration reduction within the plume (17 percent of discharge concentration contour line), added to the ambient groundwater concentrations, indicates that concentrations of thallium as well as all other constituents are reduced to levels below the lowest applicable groundwater or surface water standard outside of the mixing zone boundary (Table 2). The mixing zone boundaries are shown in Figure 1.

Based on chemical modeling and calculations for constituents of potential concern, discharge of the infiltration water to the alluvial groundwater in the Blackfoot and Landers Fork Valleys would not cause exceedence of human health or aquatic life standards outside the source specific mixing zones.

C. WATER QUALITY ASSESSMENT

The following discussion describes the factors considered by the Department in making its decision as specified in ARM 17.30.506:

a. *Biologically important areas*: Because infiltrated water would not discharge to any surface water body, and concentrations would not exceed aquatic life standards at the end of the mixing zones, no impact to bull trout or other aquatic life is expected.

b. *Drinking water or recreational activities*: This mixing zone analysis demonstrates that beneficial uses would not be impaired for downstream groundwater or surface water users. There are no domestic wells within or near the designated mixing zones. The mixing zones would have a minimum practicable effect on water users because the nearest domestic well is beyond the point where the concentrations of constituents are diluted to below human health standards.

c. *Attraction of aquatic life to the effluent plume*: Not applicable to groundwater mixing zones.

d. *Toxicity/persistence of the substance discharged*: Metals in general do not persist in the subsurface. As learned in the 1995 pump and tracer tests, metals dropped out of solution as soon as they were exposed to oxygen and accumulated on the bottom of the trench. Any metal ions that might have migrated into the subsurface were attenuated within a very short distance. Thallium is the main constituent of concern in the proposed discharge water in that it governs the mixing zone dimensions. The human health standard for thallium is 0.0017 mg/L. No aquatic life standard has been set for thallium.

e. *Passage of aquatic organisms*: Not applicable to groundwater mixing zones.

f. *Cumulative effects of multiple mixing zones*: The cumulative effects of the three mixing zones proposed for the 1997 tests have been evaluated in this statement of basis. No elevated levels of metals are detectable within the

mixing zones designated for the 1995 and 1996 pump tests, therefore, no cumulative effects exist.

g. *Aquifer characteristics*: Aquifer characteristics are well documented and reasonably well understood for the Blackfoot and Landers Fork alluvial aquifers. The pump tests and tracer tests performed in 1995 and 1996 yielded a great deal of information regarding the fate and transport of metals and other constituents in the local groundwater systems. This information was used to designate the three mixing zones for the 1997 water well tests.

h. *Groundwater discharges to surface water*: The infiltration sites have been located where there is no likely groundwater flow path to known or inferred gaining portions of the Blackfoot River or the Landers Fork. For informational purposes an additional analysis was performed and presented in this statement of basis that shows that the infiltration water would be diluted below aquatic life standards at the end of the designated mixing zones.

i. *Discharges to intermittent and ephemeral streams*: Not applicable, applies to direct discharge to a dry stream channel.

D. WATER QUALITY STANDARDS

The Blackfoot and Landers Fork alluvial aquifers are designated as Class I groundwaters suitable for public and private water supplies, culinary and food processing purposes, irrigation, livestock and wildlife watering, and for commercial and industrial purposes with little or no treatment. Class I groundwaters have a specific conductance of less than 1000 micromhos/cm at 25 degrees C.

Effluent limitations and mixing zone dimensions are based upon compliance with Montana Numeric Water Quality Standards (Circular WQB-7).

E. SELF MONITORING REQUIREMENTS

Upon issuance of this permit, the following locations must be monitored at the frequency indicated and the monitoring data must be reported to DEQ monthly. At completion of the pump test monitoring program the monitoring data must also be submitted in STORET format. Test procedures, required containers, preservation techniques, and holding times must comply with 40 CFR 136.3 Tables IB and II.

Monitoring Location	Frequency
• Water quality from monitoring wells to be installed 100 feet downgradient of infiltration sites #1, #2, and #3.	Weekly
• Water quality and flow from outlet of discharge pipe at infiltration sites #1, #2, and #3.	Weekly
• Water quality and flow from surface water monitoring stations SW-1.B, SW-46.B, SW-44.L, and SW-15.L	Biweekly
• Discharge rates from the 6 pumping wells.	Daily
• Water quality from the downgradient domestic well.	Quarterly

Regardless of the length of the test, monitoring of the alluvial groundwater down gradient of the infiltration trenches will continue for eight months following the end of the test and monitoring at the domestic well will continue for one year following the end of the test. In addition, all groundwater and surface water locations indicated above must be sampled before the test begins to establish baseline conditions.

The following constituents must be monitored at the locations designated above:

Field Conductivity	Iron[1]
Field pH	Lead[1]
Hardness	Manganese[1]
Temperature	Thallium[1]
Antimony[1]	Zinc[1]
Arsenic[1]	

[1]Dissolved analysis for monitoring wells, total recoverable analysis for surface water.

F. CONTINGENCY PLAN

If pollutants migrate beyond the mixing zone at concentrations greater than the allowed limits, or if monitoring indicates a trend toward an exceedence of limits, the pumping test must be terminated, the Department of Environmental Quality must be notified, and an evaluation initiated, to determine effects to downstream users and aquatic life.

Prepared By: Joe Gurrieri, DEQ, Permitting and Compliance Division

Date: April 1997

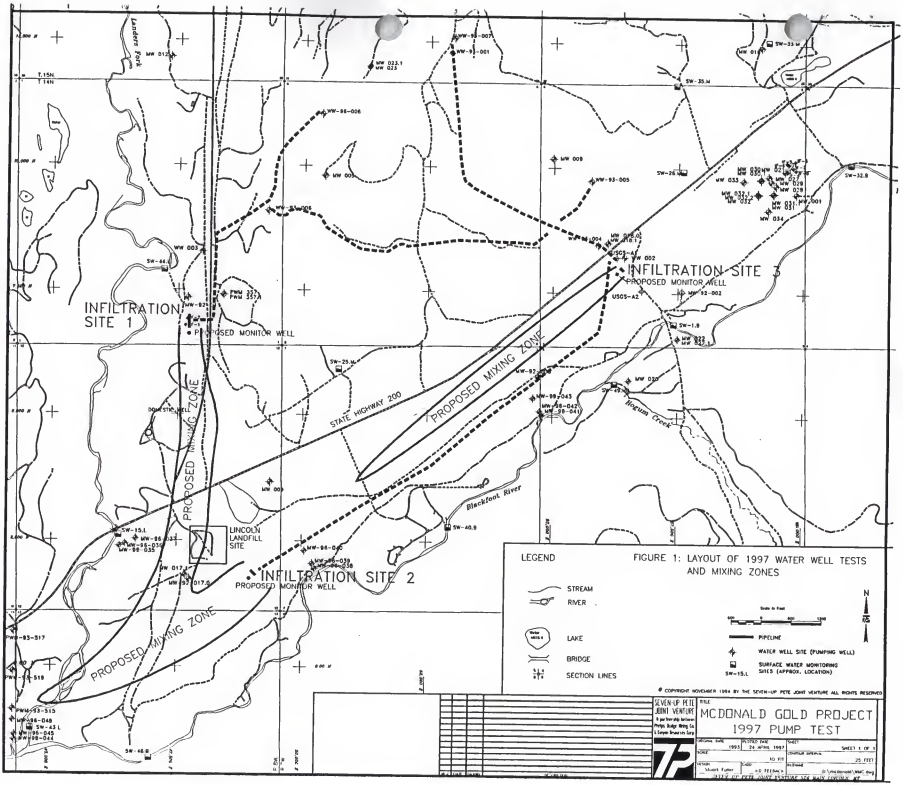

FIGURE 1: LAYOUT OF 1997 WATER WELL TESTS AND MIXING ZONES

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MCDONALD GOLD PROJECT
1997 PUMP TEST

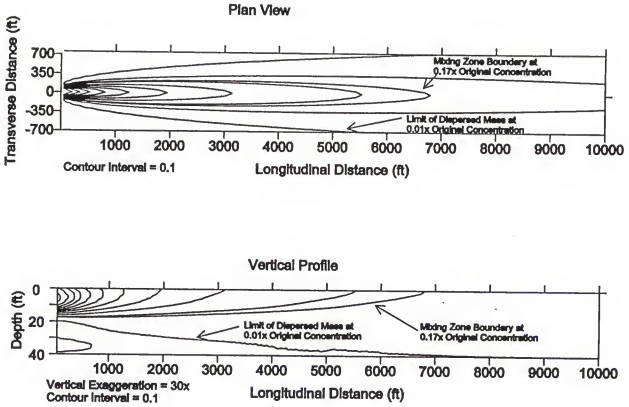

Figure 2. Results of continuous source model showing concentration reduction contours for infiltration site 3.

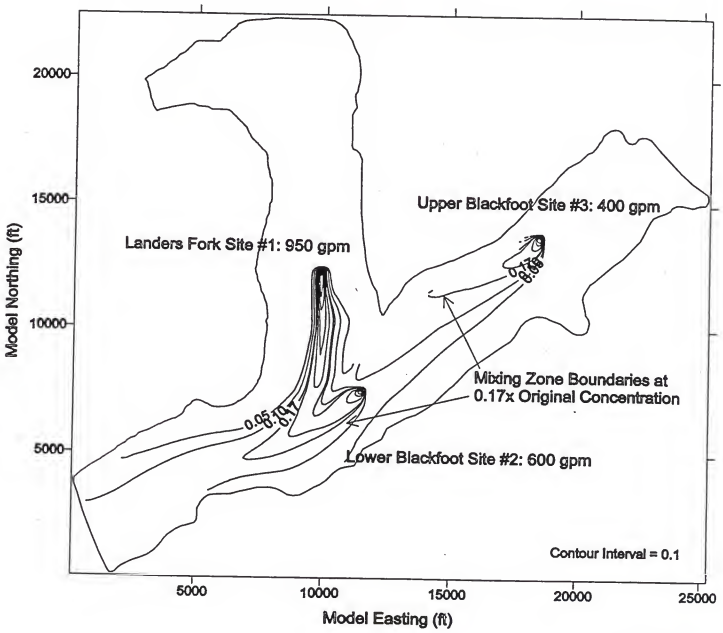

Figure 3. Results of numerical model showing concentration reduction contours for infiltration sites 1, 2, and 3.